64000

HP64000 Logic Development System

Model 64500S PROM Programmer Reference Manual

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PROM Programmer Reference Manual

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PROM Programmer

Introduction

This manual provides instructions for installing and operating the Model 64000 PROM Programmer option. The first part of the manual describes the Model 64000 PROM Programmer option and shows you how to install it in a Model 64000 terminal. All of the error messages that can be displayed by either PROM programmer version are listed and described at the end of this manual.

Description

The Model 64000 PROM Programmer option provides the capability to program, verify, and read popular bipolar and MOS PROM's. Each option includes a 64502A PROM Interface Module, a 64501A Control Card, a special cable (HP Part No. 64501-61601), and a choice of unique personality PROM modules. The PROM Programmer option always includes circuitry for the operator self test and for the service self test.

Table 1 lists power supply requirements of the PROM Programmer option. This information will help you determine how many circuit cards can be loaded into the card cage of your terminal.

Table 1. PROM Programmer Power Requirements

Power Supply	+40V	+12V	+5V	−5.2V	−12V
Typical Current	0.38A	.03A	1.07A	.01A	.01A

CAUTION

Before applying or removing system power, make certain there are no PROMs or other devices installed in any of the module sockets. To do otherwise may cause damage to the device or may alter its program.

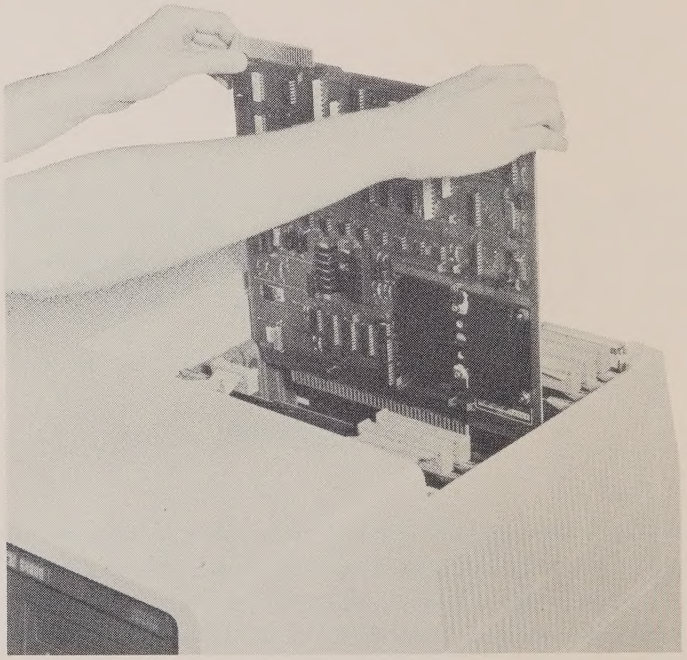


Figure 1. Control Board Installation

Installation

CAUTION

Turn off station power before installing PC card or connecting personality module.

Control Board Installation

The Model 64501A driver card must be installed in the card cage. Remove top lid by loosening the two screws in the rear of the top cover. Lift the back portion of the lid, pull slightly to the rear and remove. Install the card (component side toward front of instrument) in any card slot 0 thru 9 (see figure 1).

NOTE

To minimize cable lengths and problems, it is recommended that the PC card be placed in slot 1.

Connect the single-keyed connector of the PROM cable (HP Part No. 64501-61601) to the top left-hand connector of the circuit board.

Run the cable across the top of the card cage and down behind the right side of the front panel. Both connectors on the end of the cable should be visible in the well on the right side of the Model 64100A.

Personality Module Installation

Personality modules come with one or two connectors (see figure 2). The cable is designed for use with either type. If the module has only one connector, it is best to connect the end cable connector to the module so the module will seat fully into the well. If the personality module has two connectors, connect both cable connectors.

NOTE

The cable and module connectors are keyed so there is only one way to connect them.

After the cable is connected, place the module in the well and adjust it until it is flush. Turn the hold-down screw clockwise until it is tight.

PROM Installation

To use the Prom Programmer Module proceed as follows:

a. Prior to installing PROM into personality module, evoke the Prom Programmer Software Module.

b. After entering Prom Program mode of operation, install PROM into personality module. Pin 1 is identified on each personality module.

CAUTION

Certain PROMs can be damaged by static electricity. Observe the manufacturer's handling procedures to prevent damage. Verify the correct PROM programmer personality module is installed in the Model 64000.

c. Use any or all of Prom Programmers functions.

d. After programming session, remove PROM from personality module socket.

e. Exit Prom Programmer Software Module.

NOTE

Do not leave PROMs in the personality module socket when Prom Programmer Software Module is not in use.

Figure 2. Personality Module Installation

Operating the PROM Programmer

The following information describes how to operate the PROM Programmer. This information begins by listing all of the parameters that are common to the softkeys that appear during PROM Programmer operation. Then each of the softkeys is described in detail.

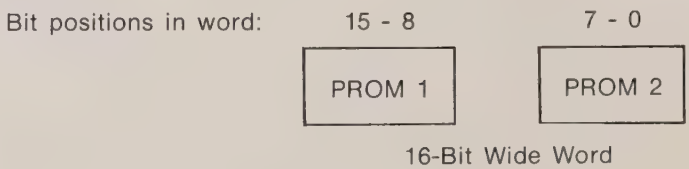
Parameters

The following parameters are used by many of the softkeys that appear during PROM Programmer operation.

<**ADDRESS**> The <ADDRESS> parameter specifies where the terminal should begin its display of PROM data. If you make no entry in this field, the terminal will begin its display with the data at address 0H. If you make an entry in this field, the top line of the display will include the data at the address you selected.

START <**value**> The start parameter specifies a starting address in the absolute or listing file where programming or reading should start. The default value is 0.

BIT <**value**> The bit parameter allows bytes and nibbles to be extracted from a file whose word size is greater than the PROM size. The bit number given is the least significant bit of the word in the file data. For instance, if a processor word is 16 bits wide and memory is going to be two 8-bit PROMs, the bit number allows programming of these PROMs from the same file as follows:



program_from FILE bit 8	PROM 1, bits 15 - 8
program_from FILE bit 0	PROM 2, bits 7 - 0

The default value of bit number is 0 (the right-most bit in the word).

ROM_ADDR The PROM address function permits programming or reading a sub range of the PROM. Normally, programming or reading will affect the whole address range of the PROM, but there are occasions when we only want to affect a sub range in the PROM. The rom_addr can specify a starting point and an ending address range in the PROM for programming or reading. In the case of rom_addr 5 thru 8, for example, programming or reading will occur in PROM addresses 5 thru 8 inclusive.

NEG_DATA If the system hardware is constructed using negative logic, it will expect the data to be complemented. In such cases, the neg_data option will perform a ones complement of the data before it is programmed into the PROM and will complement data read from the PROM.

NEG_ADDR Again, if the hardware expects an address to be negative logic, the programmer can store data at the ones complement of the address given. For example, if data would normally be programmed at PROM address 0, the programmer would store it at the ones complement of the address (in this case, the maximum PROM address).

No_Blank_Check The PROM Programmer will perform a blank check of the PROM before programming begins. Therefore, if your PROM is not blank but you still want to program it, you can override the blank check feature by using the no_blank_check instruction.

Files used by PROM Programmer

The PROM Programmer can use two types of files for programming or verifying PROM contents: absolute files and listing files. These two file types are described below.

Absolute files are created by the system linker. They contain information about the processor, the addresses where data is located in memory, and who generated the file. All of this information will be transparent to the user. The programmer is compatible with any microprocessor, regardless of word size.

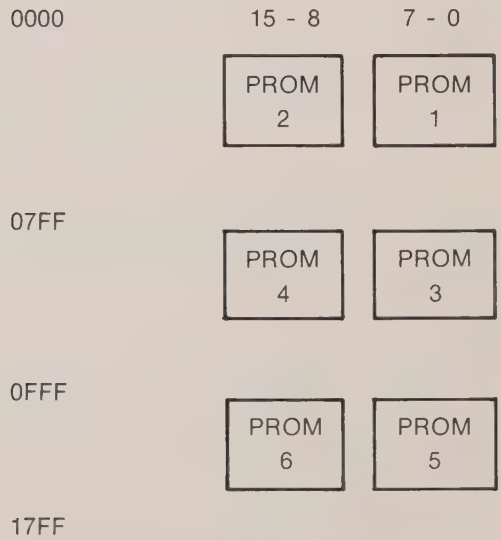
Listing files provide several features within the programmer. For instance, they allow the user to see what is in a PROM. By listing a PROM program to a file, it can be reviewed for changes or corrections via the system editor and returned to the programmer for downloading onto a PROM.

CAUTION

Syntax of the listing file is very important to the PROM Programmer. Be careful, therefore, not to change the basic structure of the file. This structure is described in Appendix A of this manual.

The list function has another important feature. It allows the user to generate a memory map which may consist of more than one ROM and cover a 32-bit address space. A list file containing bit widths up to 128 bits wide can be constructed using the bit number function. Also, by specifying the starting address, PROM data can be placed anywhere in the list file, and the existing list data will automatically be updated. For example, if we had a memory which was 6K long by 16 bits wide and we wanted to construct a file reflecting the memory shown below, we would issue the following commands to construct the list file:

```
list_rom to LIST start 0000H bit 0      for PROM #1
list_rom to LIST start 0000H bit 8      for PROM #2
list_rom to LIST start 0800H bit 0      for PROM #3
list_rom to LIST start 0800H bit 8      for PROM #4
list_rom to LIST start 1000H bit 0      for PROM #5
list_rom to LIST start 1000H bit 8      for PROM #6
```



Relationship of the File Address and PROM Address

There are three basic formats for programming a PROM with the PROM Programmer. The three formats are shown in figures 3 through 5 and discussed in the following paragraphs. All of the programming functions discussed are transparent to the user, but some explanation of how the PROM Programmer handles each of these formats will be helpful.

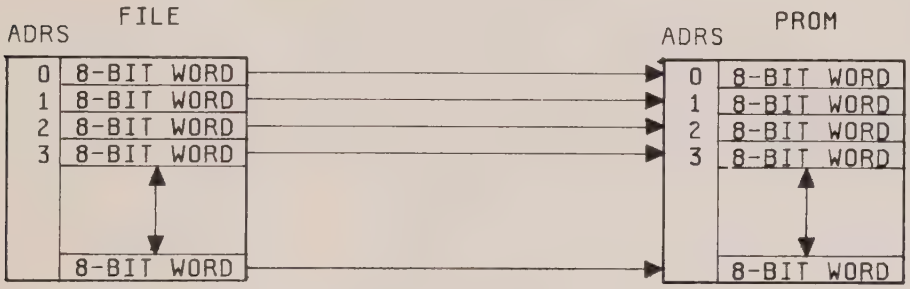


Figure 3. Programming a Single PROM where the File Addresses are the same as the PROM Addresses

Figure 3 shows the programming of a PROM where the word size in the file is the same as the word size of the PROM. In this situation, you insert the PROM in the Programmer Module, press the program softkey, and type in the name of your file. When you press RETURN, the terminal will automatically take the data word from file address 0 (bit-by-bit) and program it into PROM address 0. Then it will take the word from file address 1 and program it into PROM address 1. It will continue this process until it reaches the end of the file.

Parameters are available in the PROM Programmer to help you overcome special programming problems. The parameters can be used as follows:

a. In the case where your file is too large to be contained in one PROM, you will have to distribute blocks of your file over several PROM's. You can program your first PROM from file address 0, but subsequent PROM's will have to be programmed from addresses located further into the file. The start <value> parameter is provided to help you accomplish this task. When you include a start <value> in your command, the first word taken from the file will not come from address 0. Instead, it will come from the file address you specify in <value>. The next word will be taken from <value>+1, the word after that from <value>+2, etc.

b. There is also a parameter that lets you program a portion of the available space in the PROM without programming the entire PROM. You can specify the address where programming will start in the PROM. You can also format the command as <value> thru <value> if you want to program a limited portion of the center of the PROM without affecting the content on either end of the PROM. The parameter to use for this requirement is the rom_addr parameter. If you include a rom_addr <value> in your command, the first word taken from your file will be programmed into the PROM at PROM address <value>. The next word taken from your file will be programmed into PROM address <value>+1, etc.

c. You can use the start and rom_addr parameters together to program activity starting at any file address and any PROM address.

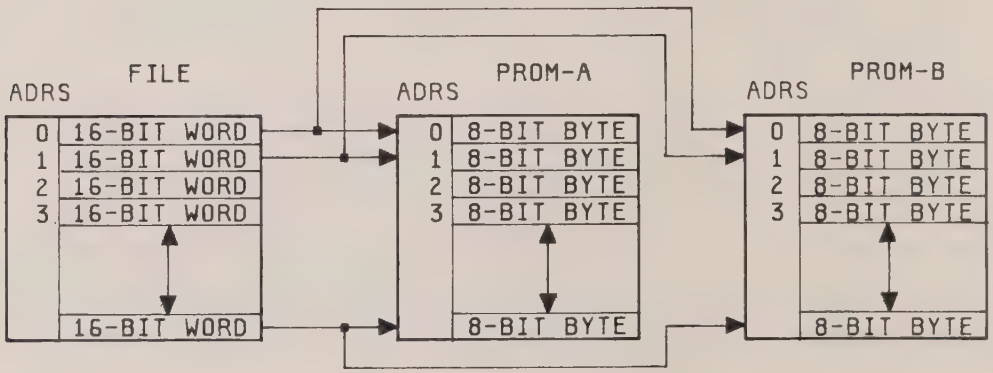


Figure 4. Programming Multiple PROM's where the File Address is the same as the PROM Address

When you are programming a set of PROM's like those shown in figure 4, you can only program one of the PROM's at a time (you might program PROM-A first and then program PROM-B next). To accomplish this programming, you will need to use the bit <value> parameter. To program PROM-A, you can simply specify a command of program <the name of your file>, RETURN. The PROM Programmer will program bits 0 through 7 of each word into the PROM and send bits 8 through 15 of each word to a location unrecognized by the Programmer Module.

Then you will need to add the bit <value> parameter to your command before you can program the next PROM. This time your command line will read program <the name of your file> bit <8> RETURN . This command will cause the PROM Programmer to send the first eight bits of each word to a location unrecognized by the Programmer Module and begin programming into the PROM with bit 8 of each word. The PROM Programmer reads every bit each time it goes through your file, but it only enters the specified bits into the PROM.

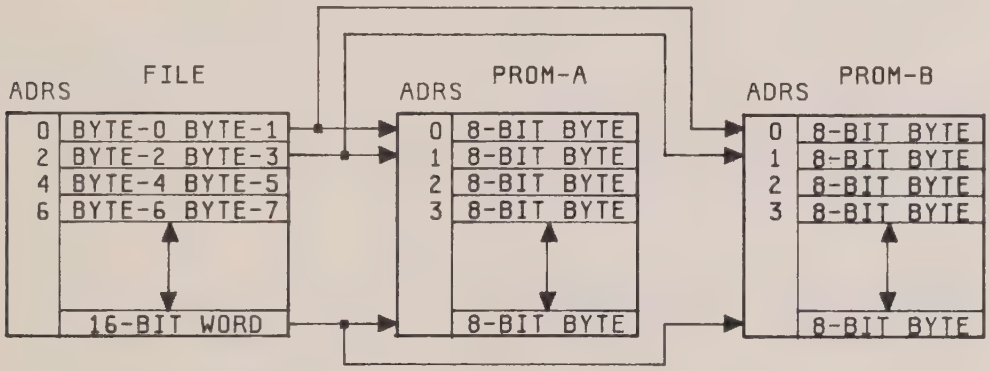


Figure 5. Programming Multiple PROM's where the File Address is different from the PROM Address

When you are programming PROM's in a situation like figure 5, you may find that the data is programmed into PROM addresses which are different from the addresses you expected to see. As shown above, you would find the first byte of the word at file address 200H programmed into PROM address 100H.

In figure 5, the PROM Programmer divides each word in your file into bytes and programs the bytes into consecutive PROM locations. The PROM Programmer accomplishes this task by making multiple passes through the file. On the first pass, the PROM Programmer will take all of the even numbered bytes and program them into PROM-A. It will send the odd-numbered bytes of each word to addresses which are not recognized by the Programmer Module. You must insert the other PROM into the Programmer Module before you start the next pass. Then the PROM Programmer will program PROM-B.

When it finishes programming a PROM address, the PROM Programmer will calculate the next PROM address to be programmed by using the formula shown in figure 6. The formula that was chosen to calculate the next address is universal. It will calculate correct PROM addresses for any programming arrangement, regardless of the size of the file word or the size of the PROM bytes. At the end of each pass through the file, the rom_addr parameter is incremented by 1 to begin the next pass through the file at the proper byte address in the file.

$$\text{PROM address} = \left(\text{file address} - \text{file start}\right) \times \left(\frac{\text{address base}}{\text{word size}}\right) + \text{rom_addr}$$

Where:

PROM address =	next address to be programmed in PROM.
file address =	address in file where next data unit will be obtained.
file start =	first file address where data was taken for PROM programming during this run.
address base =	Smallest unit of data the processor can address.
word size =	Number of bits addressing a data word for the processor.
rom_addr =	PROM address offset where first byte was programmed during the present run.

Figure 6. Formula PROM Programmer uses to calculate Next Addresses during programming

To format your commands when programming PROM's that correspond to figure 5, use the following procedure:

1. Insert the first PROM to be programmed into the Programmer Module.
2. Enter program <the name of your file> bit 0, and press RETURN.
3. PROM-A will be programmed automatically with the correct set of bytes from your file.
4. Remove PROM-A.
5. Insert PROM-B.
6. Enter program <the name of your file> bit 8, and press the RETURN key. PROM-B will be programmed with the corresponding set of bytes from your file.

NOTE

You can program a set of PROM's with more than two PROM's in the set by using the PROM Programmer. Simply repeat steps 2 through 6 of this procedure, and select the correct bit numbers until all of your PROM's are programmed.

PROM Programmer Self-Check

To evoke the PROM programmer self-check, proceed as follows:

1. Select the opt_test softkey and press RETURN. The display will show a list of modules which offer Option Performance Verification, and identify the slots where each is located.

2. Press the number key on the keyboard that identifies the Slot # of the Prom Programmer, and press RETURN.

   The display will show:

   POSITIVE PROM PROGRAMMER TEST
   STATUS: Ready for prom tests

3. Press the appropriate softkey:

   START CYCLE END_TEST ____ ____ ____ DAC=10V S/A

   If no failures are indicated, the system will display STATUS:

   DIGITAL TESTS PASSED.

4. Press END_TEST. This is the extent of the operator's self-check. For a detailed test, refer to the PROM Programmer Service Manual.

Softkeys used by the PROM Programmer

Table 2 lists each of the softkeys that is used in the operation of the PROM Programmer, and describes their functions. On the pages following table 2, each of these softkeys is discussed in detail.

Table 2. PROM Programmer Softkeys

Softkey Name	Function Selected
program	Causes the terminal to program and verify your PROM from the absolute file or listing file you specify.
verify	Causes the terminal to compare the data in your PROM with the data in the absolute file or listing file you specify.
list	Causes the terminal to create a list of the content of your PROM either on the printer or in a listing file.
check_sum	Causes the terminal to display a 32-bit total of all data stored either in your PROM or in the file you specify.
prog_loc	Causes the terminal to program only the PROM address you specify.
read-loc	Causes the terminal to read only the PROM address you specify.
display	Causes the CRT to display the data at any PROM location you specify.

SYNTAX

program_from <FILE> **[**parameters**]**

Parameters

start <value>	starting file address, default 0
bit <value>	lsb of data unit, default 0
rom_addr <value> thru <value>	PROM sub range, default entire PROM
neg_data	negative logic for data, default positive if not given
neg_addr	negative logic for address, default positive if not given
no_blank_check	turns off the automatic blank check feature

FUNCTION

This function programs a PROM from either an absolute or a listing file. Each time a location is programmed, the location is read and compared to the file data. If the comparison does not match, the location is reprogrammed and compared again in an attempt to match the file data. This will occur five times. After the fifth try, the programmer will stop and display a message on the status line stating that the programming function has failed, and programming will stop. If no programming errors occur, the PROM will be programmed and an automatic verification of the PROM will be performed to make sure that programming one location did not affect any others.

SYNTAX

verify_from <FILE> **[**parameters**]**

Parameters

start <value>	starting file address, default 0
bit <value>	lsb of data unit, default 0
rom_addr <value> thru <value>	PROM sub range, default entire PROM
neg_data	negative logic for data, default positive if not given
neg_addr	negative logic for address, default positive if not given
listfile <FILE>	list of locations which fail verify

FUNCTION

The verify command will compare file data with data in the PROM and report the number of failures on the status line. If the PROM verifies, the status will read:

Verify complete, no errors

If the PROM does not verify, the number of failures will be displayed on the status line. Also, if a list file is specified, then a summary of the failures will be listed with PROM address, PROM data, and file data. If the verify does not find any data in the range specified, a warning message will be displayed stating that no locations were verified.

SYNTAX

list<FILE> **[**parameters**]**

Parameters

start <value>	starting file address, default 0
bit <value>	lsb of data unit, default 0
rom_addr <value> thru <value>	PROM sub range, default entire PROM
neg_data	negative logic for data, default positive if not given
neg_addr	negative logic for address, default positive if not given

FUNCTION

The list instruction allows the user to obtain a list of PROM contents by listing them to a file or to the printer directly. The list file can then be edited and used to construct memory maps of several PROMs. (Refer to paragraph entitled "File Data".)

SYNTAX

check_sum rom **[**parameters**]**

Parameters

rom_addr <value> thru <value>	PROM sub range, default entire PROM
neg_data	negative logic for data, default positive if not given
neg_addr	negative logic for address, default positive if not given

check_sum <file> **[**parameters**]**

Parameters

start <value>	starting file address, default 0
bit <value>	lsb of data unit, default 0
rom_addr <value> thru <value>	rom sub range, default entire rom
neg_data	negative logic for data, default positive if not given
neg_addr	negative logic for address, default positive if not given

FUNCTION

The check sum is a 32-bit sum of all data in the specified range in the PROM or from the file.

SYNTAX

program_location <address> to <value>

FUNCTION

This function permits the programming of one location at a time and is useful when dealing with check sums. The address specified must be in the PROM address range, and the lower 4 or 8 bits of the value must be used. The programmer will try to program the location without checking to see if it is blank or not; then it will read the location back and compare data. The status line will tell if the location programmed or not.

NOTE

This function should not be used on any PROM which requires several passes thru the address range to program it, e.g., the 2708.

read_location

SYNTAX

read_location <address>

FUNCTION

This function will read the given location and display the data on the status line.

display

SYNTAX

display <ADDRESS>

Parameters

<ADDRESS> starting address of data display, default 0

FUNCTION

The display command will show the hex value of data stored at each location in the PROM.

Error Messages

Table 3 lists all of the messages that may be displayed when you are using the PROM Programmer.

Table 3. PROM Programmer Error Messages

- Bit number too large

  Bit number specified is too large.

- Blank check failed

  PROM is not blank.

- Continue with test?

  This question only appears after the PROM Programmer has warned you of an improper hardware configuration. If you answer yes, the PROM Programmer will allow you to continue the test.

- Ending rom address too large

  Specified end address is greater than maximum address.

- Error found while reading listing file

  This message indicates that an error was found in the list file. The error was probably made while editing the list file.

- Install 64502A prom module

  The PROM Programmer self test has detected that there is no programmer module (PROM socket) attached to the control cable.

- Mapping error

  During programming, data was sent to an address specified as illegal in your memory map.

Table 3. PROM Programmer Error Messages (Cont'd)

- More than one prom card in cage

  Two or more cards in cage. There must be only one.

- No control card in card cage, power down and insert card

  Control card not plugged in. Turn off station power and start again.

- Programming error: prom address=XXXXH, data=XXH, file data=XXH

  The indicated location failed to program. Contents of the PROM are displayed along with data from the file which should have been programmed in that location.

- Prom module not recognized

  The socket is not recognized by the software. This message indicates that there is either a hardware error or that the software does not recognize a new socket.

- Socket module not connected

  Socket is not connected to PROM Control Card. Check cables.

- Starting rom address too large

  PROM address is greater than maximum address.

- Test voltage overload, check prom or socket

  When programmer is initialized, the socket is checked to see if it is drawing too much current. If this error message occurs, it indicates that there is either a hardware problem or that the PROM is plugged in upside down.

- User memory

  During programming, data was sent to an address specified as user memory in your memory map.

- Verify failed XXXX times

  This message indicates that the file data and PROM data did not match during the verify command.

Table 3. PROM Programmer Error Messages (Cont'd)

- Warning, no file data found in address range.

  When verifying a file, if none of the file data is mapped into the PROM space, this message will be displayed.

- Warning, Test may damage prom module, Install 64502A

  This message is displayed when the PROM Programmer self test detects any PROM socket other than a 64502A Programmer Module installed. Only the 64502A Programmer Module is capable of handling the voltage produced during performance verification.

Appendix A

PROM Listfile Format

The list option of the PROM Programmer can be used to list the contents of a PROM to the printer or to a listfile. The PROM Programmer can also program PROM's from listfiles, if the listfiles have been created in a particular format. The format that the PROM Programmer uses to create listfiles and/or to program PROM's is as follows:

<address> data data data data data , etc

The listfile <address> is similar to an address in an absolute file. It indicates that the next piece of data will reside at the address specified:

Example

<0000> 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F

Here, the file address is <0000> and the data in that location is 00. The next address is <0001> and the data in that location is 01, etc.

Listfiles, like their absolute file counterparts, can range in width from 8 to 128 bits. In cases where more than one PROM is required to create the word width for a processor the PROM Programmer can still create a single listfile to store the program, as described above. The number of characters in the data field of your command tells the PROM Programmer the size of the data word. For example, if you are using two 8-bit ROM's to store 16-bit data words, you might issue the following command:

list_rom_to FILE start 0 bit 0

You might get the following listfile:

<0000> 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
<0010> 10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F

This listing would contain the lower 8 bits of each data word. Then by inserting the high order PROM and issuing the following list command:

```
list_rom_to FILE start 0 bit 8
```

The listfile might appear as follows:

```
<0000>  0000 0101 0202 0303 0404 0505 0606 0707 0808 0909 0A0A 0B0B 0C0C
<000D> 0D0D 0E0E 0F0F 1010 1111 1212 1313 1414 1515 1616 1717 1818 1919
```

In this example, the data stored in the upper 8 bits of each location is the same as the data stored in the lower 8 bits. Note that there are four characters in each data word. This indicates that the data width is 16 bits, each character represents 4 bits. The starting addresses are automatically adjusted in the listing because fewer data words can be shown on one line.

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